3.37 Search Modes Functional Element Sensitivity

RADGUNS provides three radar search modes: sector search, circular search, and perfect cuing. Sector and circular search modes are modeled by subroutines SRCH1 and SRCH2. In sector search mode, the beam makes a bi-directional sector scan within a horizontal arc which can be varied in width within a certain range. In circular search mode, the horizontal sweeps are complete circles swept in a unidirectional pattern. While simulating motion of the antenna, the radar transmits pulses at the pulse repetition frequency (PRF) while the antenna scans a volume of air space for target returns.

Perfect cuing, unlike the other two modes, does not correspond to a radar system option, but instead simulates a perfect point out in the direction of the target (i.e., a target position passed from another member in an integrated network). The radar antenna remains pointed directly at the flying target until the signal detected is above the user-specified threshold value. This mode, modeled in subroutine PERCUE, determines the longest range at which the target can be detected for the user-defined or default threshold value.

Data Items Required

Data Item		Accuracy	Sample Rate	Comments
11.1.1	Detection time	±1 s	SV/T	

3.37.1 Objectives and Procedures

The search mode detection range is sensitive to target velocity, mode selected, flight path geometry and target RCS. To determine the effect of target speed on detection range for various search modes, *RADGUNS* was executed for the following input conditions:

a.	Model mode:	DETR
b.	Target RCS:	1.0 m^2
c.	Target altitude:	200 m
d.	Target speed:	100, 200, 300 m/s
e.	Flight path:	LINEAR
f.	Radar type:	RAD1
g.	Guns:	Disabled
h.	Search modes:	Sector search width: 50, 100; Circular search 20, 40, and 60 deg/s; Perfect cuing (detection range)
i.	Output:	Time and range of detection from beginning of search

Detection time and detection range variance was examined for each of the search modes (perfect cuing, circular, and sector search). Outputs were plotted as a function of target speed.

3.37.2 Results

For the engagement modeled, perfect cuing search mode with a minimum search time of 3.0 s would be expected to return the earliest detection time, followed by perfect cuing with a minimum search time of 5.0 s, then each of the sector search modes by increasing sector width, and lastly, the circular search modes by decreasing search rates. Figure 3.37-1 correctly shows perfect cuing with a minimum search time of 3.0 s as the earliest detection time, and perfect cuing with a minimum search time of 5.0 s at exactly 2.0 s later. The plots of the remaining modes, however, are not consistent with expected results. In both modes, the beam makes rapid vertical sweeps while the antenna rotates either 360 degrees in azimuth for circular search mode or back and forth across the specified sector for sector search mode. The target return must exceed the specified threshold value on two consecutive scans for a detection to occur. The anomalies shown in Figures 3.37-1 and 3.37-2 are due to the elevation scan pattern that causes targets at certain geometric locations (and thus at certain speeds) to be missed during one of the two consecutive scans required for detection.

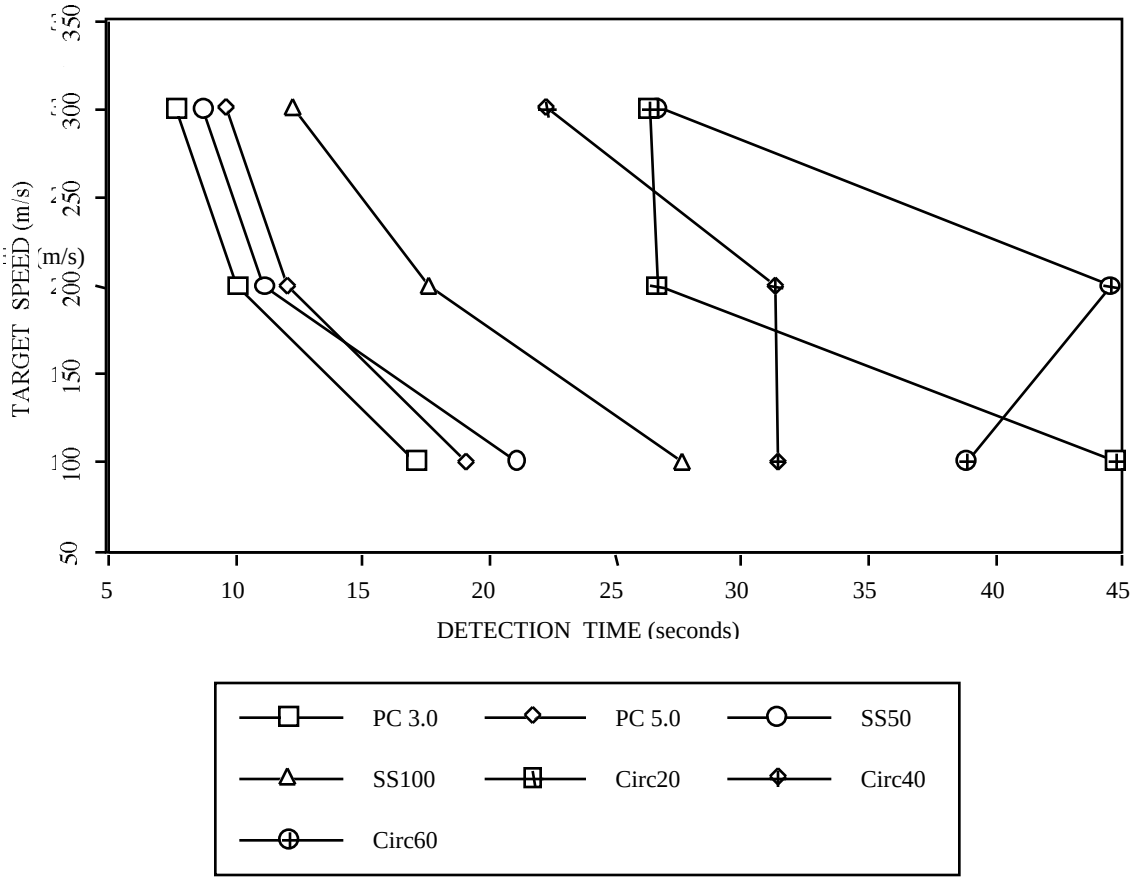

FIGURE 3.37-1. Target Speed vs. Detection Time by Search Mode.

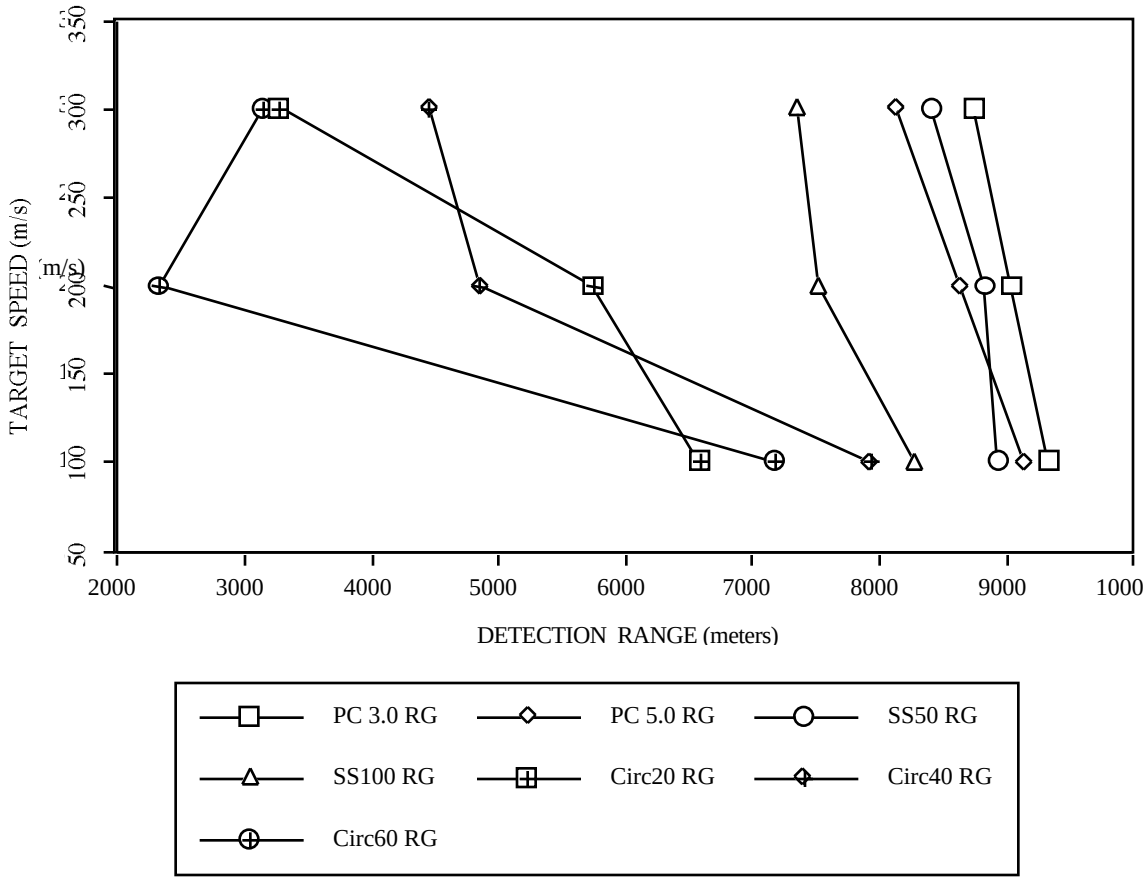

FIGURE 3.37-2. Target Speed vs. Detection Range by Search Mode.

3.37.3 Conclusions

Although detection is sensitive to the particular search mode selected, complex geometries prevent a reliable sensitivity assessment with objective quantified parameters.